

CLAIMS

What is claimed is:

1. An exhaust nozzle for a turbofan engine providing separate, non-mixed fan and core flow streams, the jet engine, comprising:

a fan nozzle;

a primary nozzle disposed at least partially within said fan nozzle;

said primary nozzle having a downstream edge portion through which a core flow stream from said jet engine exits; and

said downstream edge forming a beveled edge comprising an angle of greater than about five degrees relative to a reference plane bisecting said downstream edge portion, the reference plane extending orthogonal to a longitudinal axis of the primary nozzle.

2. The exhaust nozzle of claim 1, wherein the beveled edge comprises an angle of between about 5-45 degrees relative to the reference plane.

3. The exhaust nozzle of claim 1, wherein said downstream edge includes first and second portions, said first portion forming a plane parallel to said reference plane, and said second portion forming said beveled edge.

4. The exhaust nozzle of claim 1, wherein the beveled edge comprises an outermost edge portion, said outermost edge portion being oriented at approximately a bottom dead center position.

5. The exhaust nozzle of claim 1, wherein the beveled edge comprises an outermost edge portion, said outermost edge portion being oriented at a midpoint between oppositely arranged top dead center and bottom dead center positions on the downstream edge.

6. The exhaust nozzle of claim 1, wherein the beveled edge portion is formed in part by a length of material of said primary nozzle that extends past a center plug associated with said primary nozzle to thereby encapsulate said center plug.

7. The exhaust nozzle of claim 1, wherein the beveled edge portion is formed in part by a length of material of said primary nozzle that extends past a center plug, with said length optimized for aeroacoustic performance.

8. A primary exhaust flow exhaust nozzle system for a turbofan jet engine having separate fan flow and primary flow streams, comprising:

a fan nozzle for directing a fan flow stream;

a primary nozzle disposed at least partially within the fan nozzle, the primary nozzle directing a primary exhaust flow stream and having a downstream edge portion through which said primary exhaust flow stream from said jet engine exits said primary nozzle; and

said downstream edge portion of said primary nozzle forming a non-linear edge comprised of two adjacent, linear portions.

9. The exhaust nozzle system of claim 8, wherein the two adjacent portions are arranged to have a dividing line therebetween at a mid-point of said downstream edge.

10. The exhaust nozzle system of claim 8, wherein at least one of the adjacent portions is formed to comprise a beveled edge surface for said downstream edge portion.

11. The exhaust nozzle system of claim 10, wherein the beveled edge surface is oriented with the beveled edge surface at a bottom dead center position of the primary nozzle.

12. The exhaust nozzle system of claim 10, wherein the beveled edge surface comprises an angle of at least about 5 degrees relative to a plane extending perpendicular to a longitudinal centerline of the exhaust nozzle.

13. The exhaust nozzle system of claim 8, further comprising a center plug disposed at least partially within the primary nozzle.

14. The exhaust nozzle of claim 13, wherein a shape of the center plug is formed for optimum aeroacoustic performance.

15. The exhaust nozzle system of claim 13, wherein the center plug is completely enclosed within the primary nozzle.

16. An exhaust system for a turbofan jet engine having separate bypass flow and core flow streams, the system comprising:

a bypass nozzle for directing said bypass flow stream;

a primary nozzle for directing said core flow stream, said primary nozzle having a downstream edge that is formed with a beveled edge surface, wherein the beveled edge surface is oriented to extend at a circumferential position on the downstream edge that is intermediate a top dead center position and a bottom dead center position of the primary nozzle.

17. The exhaust system of claim 16, wherein the downstream edge comprises first and second portions, the first portion being arranged perpendicular to a longitudinal centerline of said primary nozzle, and the second portion forming said beveled edge surface, said beveled edge surface being arranged adjacent to the first portion.

18. The exhaust nozzle of claim 16, wherein the downstream edge comprises first and second portions, the first portion being arranged to form the beveled edge surface, and the second portion arranged to form an additional beveled edge surface having a bevel angle that differs from a bevel angle of the beveled edge surface.

19. The exhaust nozzle of claim 16, wherein the downstream edge comprises first and second portions, the first portion being arranged to form

the beveled edge surface, and the second portion arranged to form an additional curved surface.

20. The exhaust system of claim 16, further comprising a center plug disposed partially within said primary nozzle to extend from said downstream edge.

21. The exhaust system of claim 20, wherein a shape of the center plug is optimized for optimum aeroacoustic performance.

22. The exhaust system of claim 18, further comprising a center plug disposed within said primary nozzle so as to be completely housed within said primary nozzle.

23. A method for forming an exhaust system for use with a turbofan jet engine having separate, non-mixed bypass and core flows, the method comprising:

forming a bypass nozzle;

forming a primary nozzle and disposing the primary nozzle concentrically with the bypass nozzle;

forming the primary nozzle with a downstream edge that is beveled relative to a longitudinal centerline of the exhaust nozzle; and

further forming the exhaust nozzle such that an angle of said beveled downstream edge is greater than approximately 5 degrees.

24. An exhaust nozzle for a turbofan engine providing separate, non-mixed fan and core flow streams, the jet engine, comprising:

a fan nozzle;

a primary nozzle disposed at least partially within said fan nozzle;

said primary nozzle having a downstream edge portion through which a core flow stream from said jet engine exits; and

said downstream edge having first and second portions, said first portion forming a linear edge, parallel to a reference plane bisecting said downstream edge portion, the reference plane extending orthogonal to a longitudinal axis of the primary nozzle, and the second portion forming a curving edge surface.

25. An exhaust nozzle for a turbofan engine providing separate, non-mixed fan and core flow streams, the jet engine, comprising:

a fan nozzle;

a primary nozzle disposed at least partially within said fan nozzle;

said primary nozzle having a downstream edge portion through which a core flow stream from said jet engine exits; and

said downstream edge portion forming a curving edge.

26. The exhaust nozzle of claim 25, wherein said downstream edge includes first and second portions, said first portion including a linear edge portion, and said second portion forming said curving edge.